- An optical emission analysis system configured for use with a source of
 excitation energy and a spectrograph including an image sensor having an array of pixels,
 the system comprising:
- a probe for collecting optical sample data;a source of calibration light; and
- optical elements for directing the optical sample data and calibration light to the spectrograph so that adjacent data and calibration channels are formed on the image sensor.
- 2. The system of claim 1, wherein the optical sample data is representative of 2 a Raman or fluorescence emission.
- 3. The system of claim 1, wherein each data channel is bounded on either 2 side by an adjacent calibration channel.
 - 4. The system of claim 1, wherein:
- each data channel is bounded on either side by an adjacent calibration channel; and
- 4 interpolation is used between the calibration channels to determine the wavelength calibration of the data channel.
- 5. The system of claim 1, wherein the optical sample data is dispersed by a plurality of optical gratings such that higher and lower frequency components form different data channels on the image sensor, each adjacent to a calibration channel.
- 6. The system of claim 1, further including a broadband source of light that may be selectively directed onto the image sensor to directly determine binning ranges of calibration channels.

- 7. The system of claim 6, wherein the binning ranges or data channels are 2 determined by interpolation of the calibration channel binning. 8. The system of claim 1, further including: 2
- a plurality of remote optical measurement probes; and a plurality of optical switches for routing optical sample data from each probe to 4 the spectrograph on a selective basis.
- 9. The system of claim 1, further including: 2 a plurality of remote optical measurement probes; and a plurality of optical switches for routing optical sample data from each probe to 4 the spectrograph on a simultaneous or sequential basis.
- The system of claim 1, further including: 2 a plurality of lasers; and optical switches for routing the light from the lasers to the probe on a selective 4 basis.
- 11. The system of claim 1, wherein the data and calibration channels are tilted 2 relative to the array of pixels.
- 12. The system of claim 1, further including: 2 a laser source; and

optical switches for:

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- 4 a) selectively routing light from the laser source to a material having a known spectral response relative to the laser, and
- 6 b) selectively routing the known spectral response to the spectrograph for use as a laser wavelength calibration channel.

- 13. The system of claim 12, wherein the optical switches may be configured 2 for use as laser shutter.
- 14. The system of claim 12, wherein the material having a known spectral response is an edge-illuminated diamond wafer.
- 15. The system of claim 1, further including optical detectors at points where optical leakage may occur to provide system status or diagnostic information.
- 16. The system of claim 15, wherein the points where optical leakage may occur include optical fibers with controlled bends.
 - 17. The system of claim 1, further including:
- an intrinsically safe laser interlock circuit carrying a limited current to and from the optical measurement probe using wires cabled with the optical fibers to monitor the
- 4 integrity of the cable link; and
- an optical illuminator disposed at the location of the probe and connected to the circuit to simultaneously monitor optical path integrity and provide a visual indicator at a probe.
- 18. An optical emission analysis system configured for use with a source of excitation energy and a spectrograph including an image sensor having an array of pixels, the system comprising:
- a probe for collecting optical sample data; a source of calibration light;
- a plurality of optical gratings operative to disperse the optical sample data into higher and lower frequency components that form different data channels on the image
- 8 sensor; and

optical elements for directing the calibration light to the spectrograph so that the data channels are between calibration channels.

- 19. The system of claim 18, wherein the data and calibration channels are tilted relative to the array of pixels.
- 20. The system of claim 19, further including a broadband source of light that 2 may be selectively directed onto the image sensor to define calibration channel binning.
- 21. The system of claim 20, wherein the binning ranges or data channels are determined by interpolation of the calibration channel binning.
- An optical emission analysis system configured for use with a laser source
 of excitation energy and a spectrograph including an image sensor having an array of pixels, the system comprising:
- 4 a probe for collecting optical sample data; and
- a source of laser calibration wavelength light derived by edge-illuminating a diamond sample or other material having a known spectral response relative to the laser.
 - 23. The system of claim 22, further including:
- a first optical fiber for delivering the excitation energy to the edge of the material; and
- 4 a second optical fiber for carrying the known spectral response to the spectrograph.
- The system of claim 22, further including an optical detector in proximity
 to the reference material for gathering at least a portion of the laser illumination to maximize laser intensity.

- 25. An optical emission analysis system configured for use with a source of excitation energy and a spectrograph including an image sensor having an array of pixels, the system comprising:
- 4 a probe for collecting optical sample data;
 - a source or calibration light;
- optical elements for directing the optical sample data and calibration light to the spectrograph so that multiple channels are formed on the image sensor;
- 8 a broadband light source; and
- one or more optical switches for routing the broadband light onto the image
- sensor to determine channel binning.
 - 26. The system of claim 25, further including:
- a plurality of optical gratings operative to disperse the optical sample data into higher and lower frequency components that form different data channels on the image
- 4 sensor.
- 27. The system of claim 26, wherein the data and calibration channels are tilted relative to the array of pixels.
- 28. The system of claim 25, wherein the data and calibration channels are interleaved.